

**NOTES ON THE DARK GREEN FRITILLARY *ARGYNNIS AGLAJA* L.  
(LEP.: NYMPHALIDAE) FROM THE ISLAND OF FLODDAY,  
OUTER HEBRIDES**

RUPERT BARRINGTON

*101 Egerton Road, Bishopston, Bristol.*

IN WESTERN Scotland and the Hebridean Islands, *Argynnis aglaja* is represented by ssp. *scotica* Watkins, a distinct and dramatic race (Plate B). It is rather variable but may be generalised as being larger than the English form, with an increase in size of black markings, and often considerable dark suffusion over the ground colour, particularly on the forewings of the female butterfly.

To my knowledge the ecology of *scotica* has not been studied, so the reason why so striking a race has evolved is not known. However it seems possible that larger size may be a response to the windy environment in which it lives, where increase in flight power would lend a distinct advantage to a butterfly that tends to range over open areas in search of mate or foodplant. Many butterflies from northern latitudes, or high altitudes, are represented by darker forms. This has been shown to be a response to the difficulty of gathering sufficient heat to raise the thoracic muscles to flight temperature. Increased dark scaling, particularly on the basal third of the wings, performs a significant heat-gathering function and the heat is efficiently transferred to the body (Douglas 1986). It is likely that this mechanism explains the dark colour of *scotica*.

It is remarkable then that Heslop Harrison (1950) records a distinct colony of the species on the small island of Flodday, south of Vatersay (towards the southern end of the Outer Hebrides), which is smaller and “differs in colour from other Hebridean specimens”. Ford (1947) describes it as a “very small, pale form”. Unfortunately no measurements are given nor any specimens figured. As may be seen from the accompanying photograph, Flodday lies close to several islands in the area, the nearest being Vatersay, just 1.25 kilometres away. All these other islands carry *scotica*. The occurrence of a separate form on such a small island is of great interest for what it might tell us about the evolution of subspecies.

**Field work**

On a trip to the Outer Hebrides in July 1997, I was especially keen to get out to Flodday to see this race for myself. No commercial boats go to the smaller islands, so it was necessary to charter a boat from Castlebay in Barra at considerable cost. The weather on 20 July was generally sunny and warm, with only a slight wind and the journey took about an hour over relievingly calm water. I have a love of islands, especially uninhabited ones, and invariably feel a certain romantic thrill in being carried in a small boat away from civilisation. The spectacular journey did not disappoint, taking us past the high cliffs of Vatersay and Sandray. Sea birds were nesting on every convenient ledge, including such northern breeding specialists as the Black Guillemot, Great Skua and the pretty brindled form of the Guillemot, which appears to have put on white eyeliner and made a slip at the end of the job.

Flodday is one of the most difficult of the small islands to land on in anything other than calm weather. Wind, tide and its entirely rocky coast must isolate it for much of the year. It was a surprise to find a small flock of sheep on the island. They must be summer grazers as the flat top of this small, rocky outcrop would be totally inhospitable after the end of the short northern summer. The island is about one kilometre long and is split into two halves since the natural arch shown to connect them on my new OS map no longer exists. Time was limited and I was only able to look at the northern half. Even on a relatively calm day the wind was still gusting over the island and most of it looked simply too exposed to harbour butterflies. However in a sheltered gully four freshly emerged male *aglaia* were found, all typical *scotica*. No females were seen. Apart from two male *Polyommatus icarus* careering over the windy top of the island no other butterflies were seen outside this gully which contained small numbers of *icarus* and *Maniola jurtina* L. ssp. *splendida* White. It would seem that Heslop Harrison's curious race of *aglaia* no longer exists, having been replaced by typical *scotica*.

#### Evolution of the race

It is part of the fascination of evolutionary biology that the disappearance of any kind of animal is as interesting as its original existence. It may be of value to consider how this race came to be and why it should now be replaced by the typical form.

It is significant that *aglaia* varies throughout its range in the Hebrides. For instance the butterflies seen on Barra were poorly developed *scotica*, while those that I have seen in collections from its neighbour South Uist are more dramatic. Extreme forms occur on Pabbay, South Rona and Rhum (which also holds a population of more typical insects). Perhaps local populations have adapted to very local conditions on different islands and the differences in their markings illustrate physiological differences.

The occurrence of a very small, pale race (in other words quite the opposite of the norm for the area), is of particular interest. Unfortunately Heslop Harrison does not actually say that the entire population on Flodday was of this form, although his words imply it.

There are probably two ways in which the population might have become so different. Heslop Harrison (1950) attributed it to the "Sewall Wright effect", which Ford (1975) calls, more accurately, Random Genetic Drift. In brief, the principle is that one allele, or expression, of a gene may spread rapidly through a very small population by chance, not because it has any adaptive advantage. This could happen because, by chance, a parent carrying the allele leaves more offspring (carrying the allele) than other butterflies (not carrying the allele) in the population. With more potential parents in the next generation now carrying this allele it could rapidly spread through the small population if chance favoured it. If this allele (or more probably a group of multifactorial alleles) were coding for small, pale butterflies then it could explain the Flodday race of *aglaia*.

However, Ford (1975) says such a situation is rare and usually short-lived, because it is unusual for a gene(s) to be of such minimal selective value that they can override the process of natural selection for any length of time. In other words, it is more likely that, for a time at least, a change in local conditions meant that mutant gene(s) coding for small, pale insects (and probably some hidden physiological advantage) had some selective advantage over the normal *scotica* form, and so this race temporarily evolved, just as other populations in the different islands have evolved more, or less, extreme expressions of *scotica*.

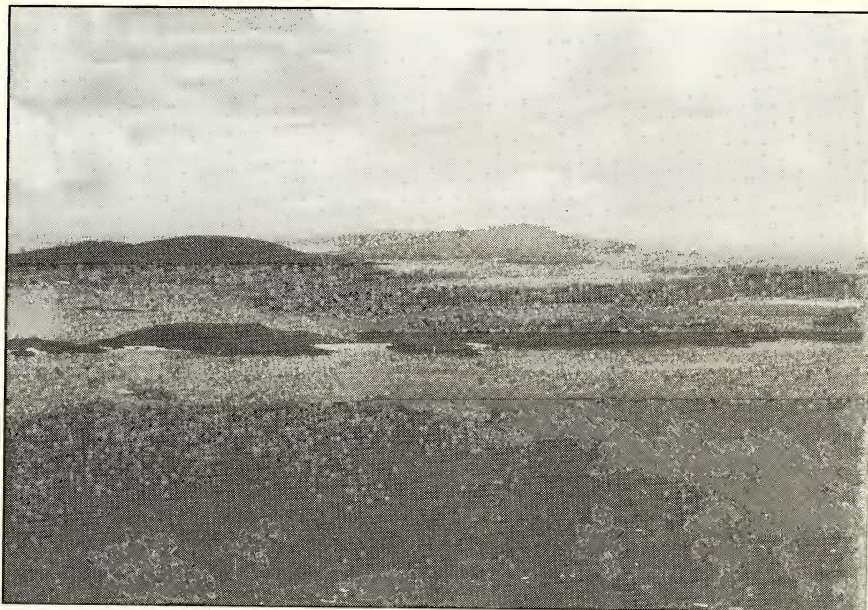
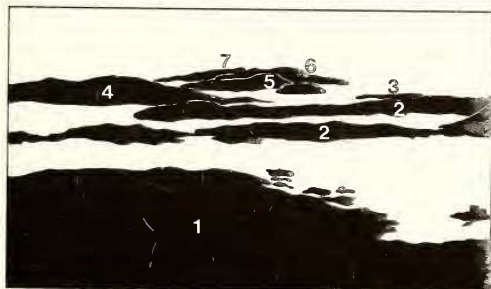


Plate A. Islands of the Outer Hebrides, looking south from Barra.

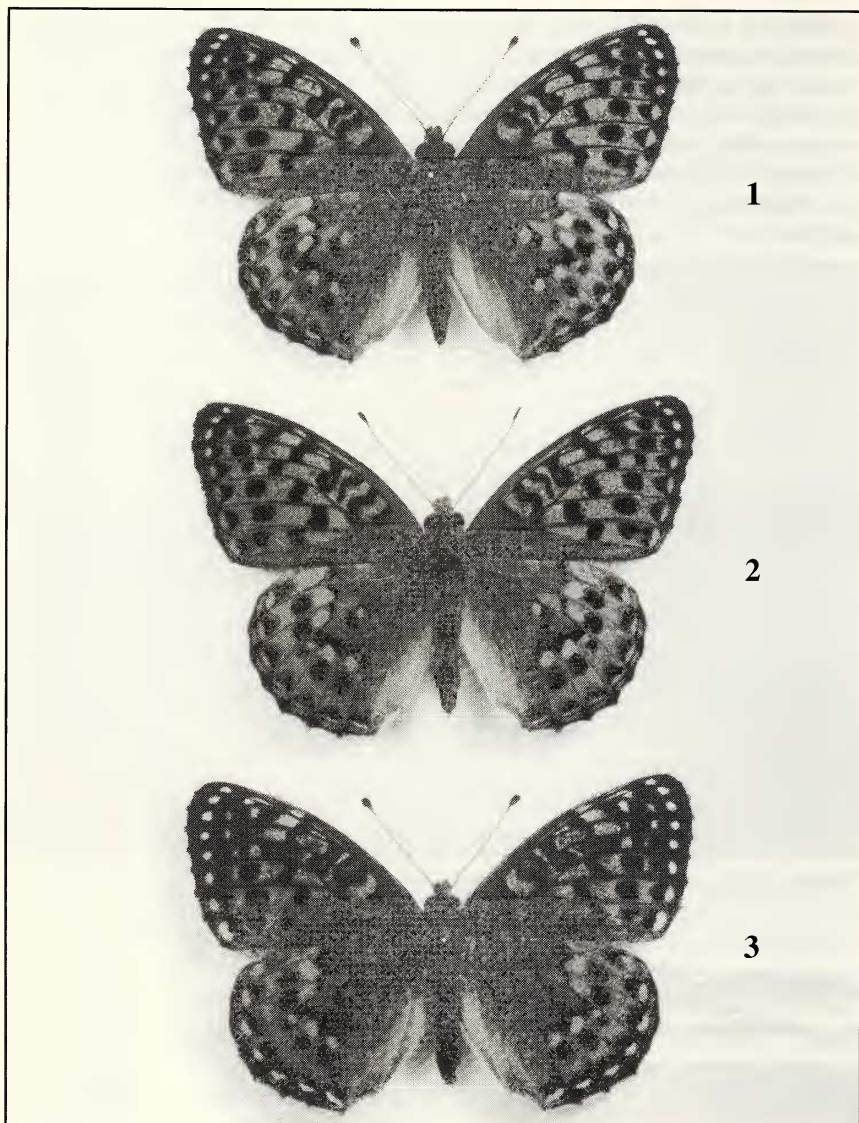


**Legend for Plate A.**

1. Barra
2. Vatersay
3. Flodday
4. Sandray
5. Pabbay
6. Mingulay
7. Berneray

This does not necessarily count out the option of Random Genetic Drift accounting for Heslop Harrison's observations, as the race may have been short-lived. Unfortunately it is not possible to discover by which mechanism this race came about.





**Plate B.** Dark Green Fritillary *Argynnis aglaja* L. ssp. *scotica* Watkins (Lep.: Nymphalidae).

1. ♂, Flodday, July 1997

2. ♂, Pabbay, July 1997

1. ♀, Pabbay, July 1997

All photographs are reproduced at natural size.

As to why the colony is now typical *scotica*, two possibilities exist both, probably, equally likely. One is that the population went extinct at some point and the island was repopulated by *scotica* from a nearby island. Given the small size of the island, and probable small size of the population, a few poor years could eliminate the population.

The second option is that selection pressures changed. Perhaps the climate was different for a few years or perhaps the introduction of grazing (or its temporary relief) changed the selection pressures on the insect, thereby rendering small, pale insects, with their particular physiology, at a disadvantage over typical *scotica*. Selection could then have returned the population to *scotica*. The process might have occurred in isolation or been aided by *scotica* immigrants from nearby islands.

The speed at which natural selection can return a divergent population to the normal form was beautifully demonstrated in the Scarlet Tiger Moth *Callimorpha dominula* L. by H.B.D. Kettlewell (Ford 1975). Over ten years Kettlewell selectively bred a captive population of *dominula* for extensive and coalesced white forewing spots and reduced black hindwing markings. These colour changes were genetically multifactorial. In 1948 he released this aberrant strain in the grounds of Tring Museum, Hertfordshire, where it bred naturally on planted food. By 1951 the population was already returning towards the typical form and by 1953 this process was almost complete. In just a few years natural selection had changed the mutant wing pattern (and doubtless mutant physiology) into almost normal wing pattern, which under wild conditions (and therefore different selection pressures from those of the laboratory) was at an advantage over the aberrant form.

### References

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### The British Tephritidae (Diptera) recording scheme – a request for data.

The British Tephritidae recording scheme was begun in 1983 and to date just under 10,000 records have been incorporated. A provisional atlas was published in 1997 and work is currently under way on an update. Given that there are only some 80 resident British species, most are very attractively patterned and that all are closely associated with flowering plants, they are an ideal group for study. I therefore invite all readers of this journal who would like to participate in the project to contact me. An identification service is provided for those who have, or think they may have, specimens of the family amongst their anonymous ranks of captures.— LAURENCE CLEMONS, 14 St. John's Avenue, Sittingbourne, Kent ME10 4NE.